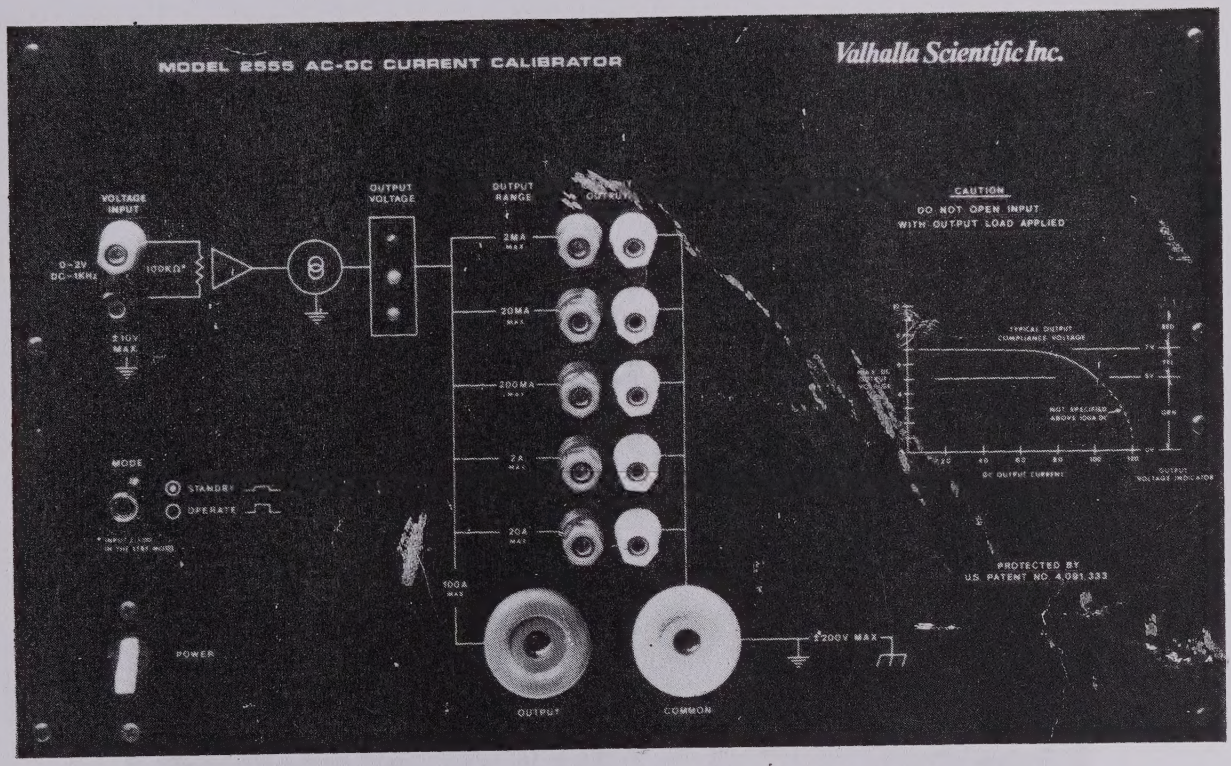


VALHALLA

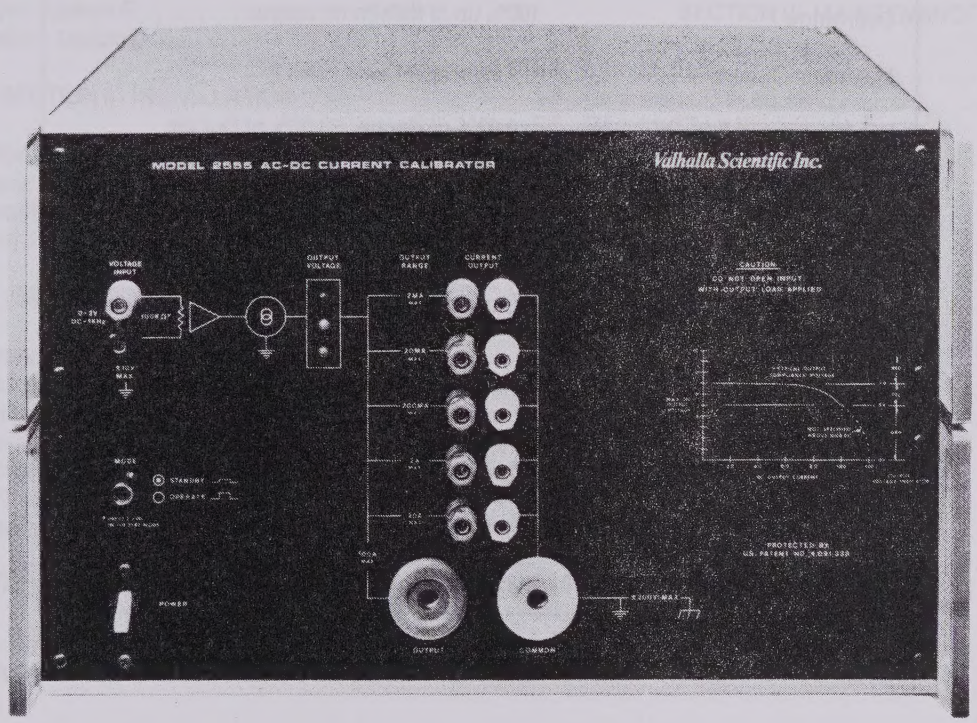
INSTRUCTION MANUAL MODEL 2555A

CERTIFICATION

Valhalla Scientific Inc. certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. Valhalla Scientific Inc. further certifies that its calibration measurements are traceable to the National Bureau of Standards to the extent allowed by NBS's calibration facility.

WARRANTY

Valhalla Scientific Inc. warrants this instrument against defects in material and workmanship for one year from date of shipment. We will repair or replace the instrument during the warranty period provided it is returned to Valhalla Scientific Inc. No other warranty is expressed or implied. We are not liable for consequential damages. Permission must be obtained directly from factory for warranty repair returns. No liability will be accepted if returned without such permission.



MODEL 2555A

AC-DC CURRENT CALIBRATOR

SPECIFICATIONS

Ranges:	0 - 100 Amperes. 0 - 10 Amperes. 0 - 1 Ampere. 0 - 100 Milliamperes. 0 - 10 Milliamperes. 0 - 1 Milliampere.
Overrange	100% up to maximum output.
Maximum Output:	100 Amperes DC or Peak AC.
DC Accuracy:	±0.02% of Range ±0.02% of Output.
AC Accuracy:	±0.1% of Range ±0.15% of Output to 1 KHz.
Input Impedance:	100K Ohms.
Compliance Voltage:	0 - 5V DC or Peak AC.
Input/Output Ratio:	1.0000 volt will produce full scale output.
Size:	10.5'' H x 17'' W x 17'' D. (26.67 cm x 43.18 cm x 43.18 cm).
Weight:	85 lbs. net, 100 lbs. shipping. (38.25 Kg net, 45 Kg shipping).

TABLE OF CONTENTS

Para.	Title	Page
	SECTION I — GENERAL INFORMATION	
1-1	Description	1-1/2-1
1-3	Accessories	1-1/2-1
1-5	Rack Mount - Option R	1-1/2-1
1-7	Cable Option - Option C	1-1/2-1
	SECTION II - INSTALLATION	
2-1	Introduction	1-1/2-1
2-3	Initial Inspection	1-1/2-1
2-6	Power Requirements	1-1/2-1
2-8	Installation	1-1/2-1
	SECTION III - OPERATION	
3-1	Introduction	3-1
3-3	Input Voltage	3-1
3-6	Range Switching	3-1
3-8	Output Current	3-1
3-10	Range Limit Indications	3-1
3-12	Standby/Operate Switch	3-2
3-14	Application Information	3-2
	SECTION IV - THEORY OF OPERATION	
4-1	General	4-1
4-3	Power Supply	4-1
4-5	Voltage To Current Converter	4-1
4-10	Range Selection	4-2
4-12	Range Indications	4-2
	SECTION V - MAINTENANCE	
5-1	Introduction	5-1
5-3	Calibration Procedure	5-1
5-5	Required Test Equipment	5-1
5-7	Output Impedance Adjustment	5-1
5-11	DC Calibration	5-1
5-12	100 Ampere Range	5-1
5-15	10 Ampere Range	5-2
5-18	1 Ampere Range	5-2
5-21	100 Milliampere Range	5-3
5-24	10 Milliampere Range	5-3
5-27	1 Milliampere Range	5-3
5-30	Frequency Response	5-3
5-32	100 Ampere Range	5-3
5-36	10 Ampere Range	5-3
5-38	1 Ampere Range	5-3
5-40	100 Milliampere Range	5-3
5-42	10 Milliampere Range	5-3
5-44	1 Milliampere Range	5-4
5-46	Range Indicator Adjustment	5-4
5-48	Troubleshooting	5-4
5-50	Power Supplies	5-4
5-54	Amplifier Servicing	5-4

LIST OF ILLUSTRATIONS

Model 2555A Precision AC-DC Calibrator ..... Frontispiece
Figure 3-1. Block Diagram, DC Error Sources 3-1
Figure 3-2. Block Diagram, AC Error Sources 3-2
Figure 4-1. Simplified Diagram, Transconductance Amplifier 4-1
Figure 5-1. Output Impedance Test Set-up 5-2
Figure 5-2. DC Calibration Test Equipment Set-up 5-2
Figure 5-3. AC Frequency Response Test Set-up 5-3

SECTION I
GENERAL INFORMATION

1-1 DESCRIPTION

1-2 The Valhalla Scientific Model 2555A AC-DC Current Calibrator is a complete wide range voltage-to-current convertor. It converts a precision input voltage to a proportional output current. For DC input voltages, the output current has the same polarity as the input voltage and output current magnitude is directly proportional to the magnitude of the input voltage. With an AC voltage applied to the input, the output current has the frequency and phase of the applied input voltage. Output current is then directly proportional to the value of the applied input voltage. Full scale ranges are selectable in decade increments from 1 milliampere full scale to 100 amperes full scale with front panel mounted jacks. Lighted panel indicators show when the output voltage is within limits, when it is nearing the upper limit and when that limit is exceeded. The unit is housed in a heavy duty aluminum case and is directly compatible with Retma rack mounting.

1-3 ACCESSORIES

1-4 The Model 2555A AC-DC Current Calibrator is shipped from the factory with mating 100 ampere output connectors and an instruction manual.

1-5 RACK MOUNT - OPTION R

1-6 The Model 2555A AC-DC Current Calibrator may be purchased with a rack mount adapter, OPTION R, for mounting in a standard 19-inch rack.

1-7 CABLE - OPTION C

1-8 This unit may be operated with an OPTION C Input/Output Cable Set.

SECTION II
INSTALLATION

2-1 INTRODUCTION

2-2 This section contains information for inspection and installation of the Model 2555A AC-DC Current Calibrator.

2-3 INITIAL INSPECTION

2-4 If the external shipping container shows evidence of in-transit damage, such damage should be immediately brought to the attention of the carrier and such damage noted on the bill of lading.

2-5 Unpack the instrument and retain the shipping container until the instrument has been inspected for possible damage in shipment. If in-shipment damage is observed, notify the carrier and obtain his authorization for repairs before returning the instrument to the factory. Where the external shipping container has shown evidence of damage in transit, but the instrument shows no external damage, it may be advisable to perform the calibration procedure of Section V to determine that the instrument has not incurred hidden damage.

2-6 POWER REQUIREMENTS

2-7 The Valhalla Model 2555A AC-DC Current Calibrator is normally shipped from the factory for operation from 105 to 125 volts AC at 50 to 400 Hz. The instrument may be ordered for operation from 210 to 250 volts AC. If conversion from 105-125 volts AC to 210-250 volts AC is required in the field, the factory should be contacted for instructions.

2-8 INSTALLATION

2-9 The Model 2555A AC-DC Current Calibrator may be used in a normal bench top configuration, or installed in a 19-inch rack. The instrument may then be connected to the precision reference input voltage and to the load to which current will be supplied.

Digitized by the Internet Archive
in 2026

https://archive.org/details/manualsplus_11664

SECTION III
OPERATION

3-1 INTRODUCTION

3-2 This section of the manual contains the complete operating instructions for the Model 2555A AC-DC Current Calibrator.

3-3 INPUT VOLTAGE

3-4 The polarity and level of the input voltage determines the polarity and level of the output current. If the input voltage is zero, the output current will be zero. As the input voltage is increased, the output current will increase linearily within the selected range. For the selected range of 1 MA, an input voltage of 1.0000 volts DC will produce an output current of 1.0000 MA. If the input is increased to 1.5000 volts DC, the output current will increase to 1.5000 MA. Similarly, if the 10 MA range is selected, the output currents will be 10.000 MA and 15.000 MA for inputs of 1.0000 volts DC and 1.5000 volts DC respectively. If the input voltage is of positive polarity, the output current will be of positive polarity. If the input voltage is of negative polarity, the output current will be of negative polarity. If an AC voltage is applied to the input terminals, the output current will have the amplitude, frequency and phase characteristics of the applied input voltage.

3-5 Maximum input voltage is 2 volts RMS or DC on all but the 100 ampere range which is limited to 1 volt RMS or DC.

3-6 RANGE SWITCHING

3-7 Range switching is accomplished manually by moving the cable connections from one set of jacks to another. The instrument ranges are defined in decade increments of 1 MA, 10 MA, 100 MA, 1A, 10A and 100A based on a 1.0000 volt input reference level. For example, if the 1 MA range is selected and 1 volt applied to the input, the output current will be 1 milliampere. If a 1 volt AC RMS input is applied, the output will be 1 milliampere AC RMS. Separate heavy duty jacks are provided for the 100 ampere range. Plugs of the same current rating are supplied for insertion into these jacks. Wire size AWG #4 or larger should be used to minimize the voltage drop in the connecting leads for the 100 ampere range.

3-8 OUTPUT CURRENT

3-9 As stated in previous paragraphs, the output current is proportional to the input voltage. A 2 volt input will produce an output current which is 200% of the selected range (eg., if the 1 MA range is selected, the output current will be 2 MA). The effective output impedence of the current calibrator approaches infinity. Therefore, the output current generating circuit will attempt to deliver the requested current into any load impedance applied to the output terminals. A 1 MA current output applied to a 1K ohm load impedance produces 1 volt across that load impedance. A 1 MA input current applied to a 2K ohm load impedance produces 2 volts, etc., until the output voltage reaches the ±7 volt DC or peak AC maximum compliance level. The 7 volt DC maximum compliance voltage corresponds to 4.95 volts RMS maximum compliance voltage for sine wave output currents.

3-10 RANGE LIMIT INDICATORS

3-11 Three LED indicators (green, yellow and red) provide the operator with indication of range limit conditions. The output voltage is within limits when the green indicator is illuminated. As the input or the load

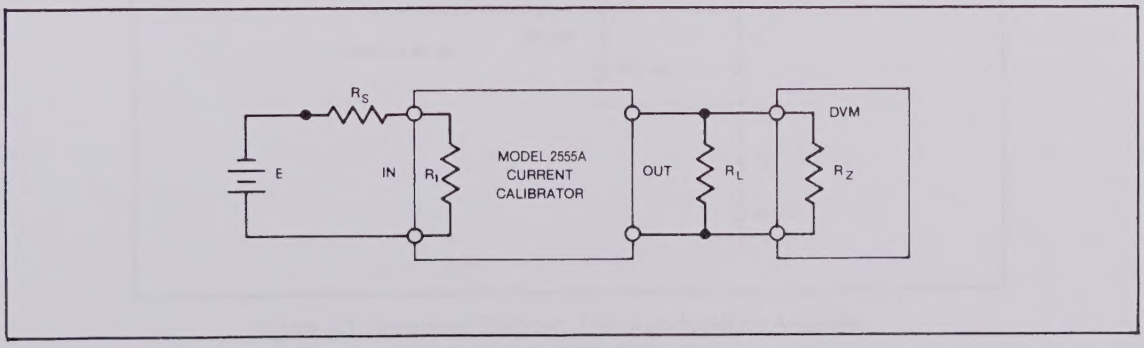


Figure 3-1. Block Diagram, DC Error Sources.

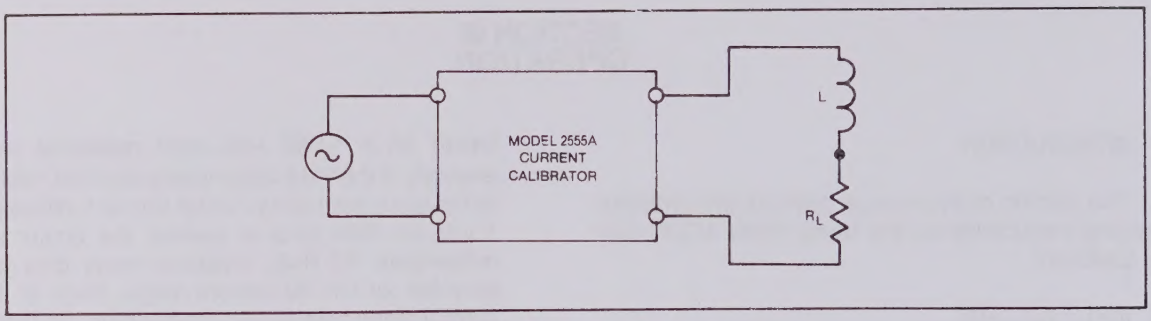


Figure 3-2. Block Diagram, AC Error Sources.

resistance is increased to the point where the output voltage is greater than ±5 volts, the green LED will be extinguished and the orange LED will light. As the output voltage increases further, the yellow LED will be extinguished and the red LED illuminated when the output voltage reaches ±7 volts.

3-12 STANDBY/OPERATE SWITCH

3-13 The STANDBY/OPERATE switch, when in the STANDBY position, disables the instrument so that it cannot supply current to the load. Moving the switch to the OPERATE position, restores normal operation.

3-14 APPLICATION INFORMATION

3-15 The application of a precision constant current source, such as the Model 2555A AC-DC Current Calibrator, requires a knowledge of potential outside error sources. The following paragraphs outline some of the more common error sources.

3-16 When measuring the DC current output of the AC-DC Current Calibrator, there are two primary potential error sources. The first occurs at the voltage input to the Current Calibrator. This error source is formed by the source impedance of the input voltage source, R_S, shown in Figure 3-1, forming a resistor divider with the 100K ohm input impedance of the Current Calibrator, R_I. To maintain the error at 0.01% or less, the ratio of R_I :R_S must be maintained at 10,000:1 or greater. Since R_I equals 100K ohms, the maximum impedance for R_S must be less than 10 ohms. The second potential error source occurs at the current output of the AC-DC Current Calibrator. This error source is the shunt impedance of the DVM, R_Z, shown in Figure 3-1, in parallel with the load impedance, R_L. To maintain the error at 0.01%, or less, the ratio of R_Z :R_L must be maintained at 10,000:1 or greater. If the input impedance to the DVM is 10 megohms, the maximum shunt impedance, R_L, should not exceed 1K ohms. For a shunt impedance, R_L, of 1 megohm, the input impedance to the DVM, R_Z, must be at least 10,000 megohms.

3-17 Another potential error source is inductance (L) in series with the load resistor, R_L, as shown in Figure 3-2. If the load resistance is 0.001 ohm and the series inductance is 100 nanohenries, the effective load impedance at 1 KHz is:

$$Z = \sqrt{0.001\,\Omega^2 + (2\pi \cdot 1\text{KHz} \cdot 100 \times 10^{-9}\text{H})^2} = 0.001181\,\Omega$$

SECTION IV
THEORY OF OPERATION

4-1 GENERAL

4-2 This section of the manual provides a description of the circuits of the Model 2555A AC-DC Current Calibrator. The circuit descriptions are referenced to the schematic diagram, Figure 5-4.

4-3 POWER SUPPLY

4-4 The circuits of the Model 2555A AC-DC Current Calibrator require two dual power sources. One delivers nominal positive and negative 15 volts DC and the other nominal positive and negative 10 volts DC. T1 and diodes CR10 through CR13 generate positive and negative potentials in the range of 20 volts DC. These are regulated to 15 volts DC by IC8 and IC9. The positive and negative 10 volt DC sources are obtained from a separate winding on T1 and diodes CR14 through CR17. These sources do not require regulation and are the collector supplies for Q3, Q5 through Q44 and Q46.

4-5 VOLTAGE TO CURRENT CONVERTER (TRANSCONDUCTANCE AMPLIFIER)*

4-6 A simplified diagram of the voltage-to-current converter is shown in Figure 4-1. The first amplifier, IC1, operates with a gain of 1 by virtue of the operational feedback loop provided by R3. The output of the first amplifier drives the inverting input of the second amplifier which operates open loop and at very high gain. The output of the second amplifier, IC2, provides a potentiometric feedback to the non-inverting input of the first amplifier. The system operates to maintain the output of the first amplifier, and the inverting input of the second amplifier, at approximately the same potential as that applied to the non-inverting input of the second amplifier. Very small differences between the inputs of the second amplifier are sufficient to drive it to full scale output.

4-7 Assume that the output terminals are shorted and 1 volt DC is applied to the input terminals with the RED input terminal positive. To equalize the inputs of the second amplifier, IC1 must be driven to zero. This is accomplished when the voltage drops across R1 and R2 are equal and those across R3 and R4 are equal. This condition will be obtained when the output of the second amplifier is at +1 volt. The currents through R1, R2, R3 and R4 are the same. Since the output of IC1 must be zero, the drop across R3 must be 0.5 volts, making the non-inverting input of IC1 +0.5 volts. R4 will have the same drop, making the inverting input +0.5 volts. The drop across R1 and R2 will be the same. Since the inputs to IC1 are essentially equal, the output of IC1 is zero (offset, of course, by the few microvolts necessary to drive the output of the second amplifier to 1 volt. Note that the

* Patent No. 4,091,333.

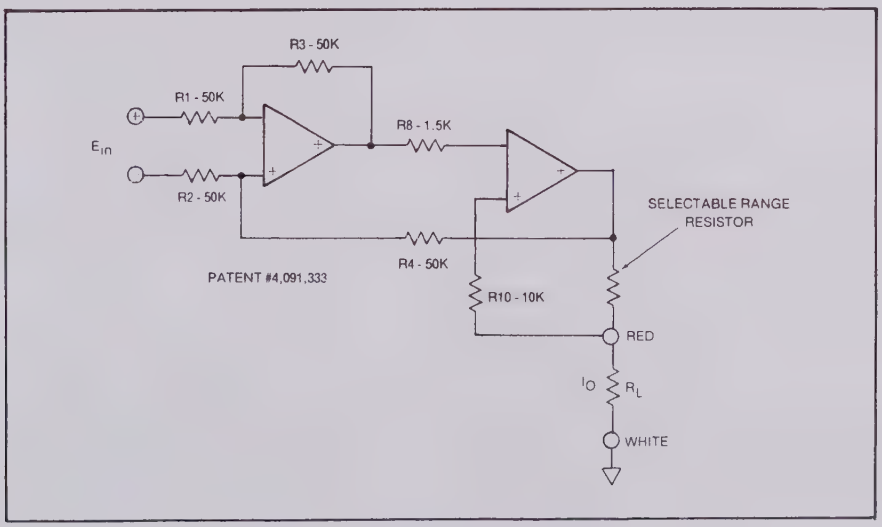


Figure 4-1. Simplified Diagram, Transconductance Amplifier. (Voltage to Current Converter)

sum of the voltages across the four resistors, R1 through R4, equal the sum of the input voltage and second amplifier output voltage.

4-8 Consider the conditions that are obtained when the short circuit is removed from the output terminals and a 100 ohm resistor is connected across them. The reference level to the non-inverting input of the second amplifier will now be above ground due to the current through the load resistor, R_L. This will drive the output of the second amplifier in a positive direction and a point of stability will be reached when the output of the first amplifier is equal to the level applied to the non-inverting input of the second amplifier. Again, this condition is obtained when the voltage drops across R1 and R2 are equal and those across R3 and R4 are equal. This will occur when the output of the second amplifier is at 2 volts. The drop across the range resistor, R_S, is then 1 volt as it was when the output terminals were shorted. The current through the load is then 10 milliamperes. Although the resistance across the input terminals has been increased from zero to 100 ohms, the current flowing across the output terminals remains at 10 milliamperes. Note that the voltage difference between the output of the first amplifier and the second amplifier is always equal to the voltage applied to the input terminals. When the input signal is increased to +2 volts DC, the potential difference between the output of the first amplifier and the output of the second amplifier increases to 2.0 volts. The drops across resistors R1 and R2 are then 1 volt and drops of 1 volt exist across R3 and R4. The current through the 100 ohm load would then increase to 20 milliamperes, proportional to the input voltage increase. If a 200 ohm resistor is connected across the output terminals, the output of the second amplifier will increase to 2.2 volts and the current through the combination of range and load resistors will remain at 20 milliamperes.

4-9 The system tends to maintain a voltage across the range resistor proportional to the input voltage. Selecting different values for the range resistor will result in different current levels through those resistors to maintain a 1 volt DC drop with 1 volt DC at the input terminals. The second amplifier, though shown as a single operational amplifier in the simplified diagram of Figure 4-1, is a current amplifier and actually comprised of IC2 and some 46 transistors, Q1 through Q46. The transistors are connected in four groups that are then connected in series-parallel to form a "totem pole" arrangement capable of passing 100 amperes to the load. The complete circuit is shown in the schematic diagram. Q2 and Q3 operate as constant current sources to bias the parallel connected sets of output transistors. R7 and R9 provide adjustment of the operational amplifier offsets.

4-10 RANGE SELECTION

4-11 The current output range of the Model 2555 is selected by manually inserting the load connectors into the appropriate range jacks. This inserts resistors of different values in series with the load, effectively changing the value of the range resistor of Figure 4-1. This is best illustrated by reference to the complete schematic diagram, Figure 5-2. Calibration potentiometers in the resistor matrix permit precise adjustments of the proportion between input voltage and output current. The adjustments of these potentiometers are covered in Section V.

4-12 RANGE INDICATORS

4-13 Refer to Figure 5-2. Level sensors of IC3 and IC4 provide the drive for the three range indicator LED's, DS1 through DS3. Those of IC3 compare the output of IC1, which is proportional to the output voltage to levels developed in the voltage divider comprised of R12 through R21. This divider is connected across the +15 and -15 volts supply lines. The inputs to IC3-1 and IC3-7 from the divider are positive with respect to ground and those to IC3-8 and IC3-14 are negative. When the output Of IC1 is between 0 and +5 volts, all of IC3's outputs are at -15V and the junction of R22, R23 and R28 is at -10V. Thus the output of IC4-1 and IC4-7 are also at -15V which forces the output of IC4-8 to +15V to light DS3 (GRN). As the output transitions +5V, the output of IC7-3 goes to +15V, forcing the output of IC4-1 to +15V, turning on DS2 (YEL), forcing the output of IC4-8 to -15V which extinguishes DS3. As the voltage transitions to +7 volts, the output of IC3-1 goes to +15V. This forces the output of IC4-7 to 15V, turning on DS1. The output of IC4-1 is forced low, turning off DS2. The output of IC4-7 holds IC4-8 at -15V, keeping DS3 turned off.

4-14 When the output is forced in the negative direction, a similar sequence occurs. However, IC3-8 and IC3-14 outputs will transition rather than those of IC3-7 and IC3-1.

4-15 STANDBY/OPERATE SWITCH

4-16 The STANDBY/OPERATE switch, when in the STANDBY position, connects the non-inverting input of IC2 directly to -10 volts DC. This removes any drive signal from the output power transistor circuits, preventing current from being supplied to the load.

SECTION V
MAINTENANCE

5-1 INTRODUCTION

5-2 This section contains the maintenance information for the AC-DC Current Calibrator. Included in this section are the required test equipment lists, calibration procedures, and troubleshooting guide.

5-3 CALIBRATION PROCEDURE

5-4 The following procedures should be performed on a routine basis to ensure that the instrument remains within calibration. The calibration procedures should also be performed after repairs to any of the accuracy determining components.

5-5 REQUIRED TEST EQUIPMENT

5-6 The test equipment required for the calibration procedures is shown in Table 5-1.

5-7 OUTPUT IMPEDANCE ADJUSTMENT

5-8 Connect the equipment as shown in the diagram of Figure 5-1 using a 1.000 ohm resistor for R_L and a 4.0 ohm resistor for R_S. Set the DC Voltage Standard output at zero volts DC. Connect the 1A range on the Model 2555A and adjust R7 for an indication on the DC Null–meter of ±100 microvolts, or less. R7 FINE "0"

5-9 Set the DC Voltage Standard to 1.00 volt DC. Adjust R105 for an indication on the Nullmeter of ±100 microvolts, or less. Open and close the switch across R_S. The output voltage displayed on the DVM should change from 1 volt to 5 volts. R105 1A

NOTE

If the Nullmeter reads less than ±200 microvolts at both positions of the switch, proceed to paragraph 5-11. If not, proceed to paragraph 5-10.

5-10 Open and close the switch across R_S and observe the direction and magnitude of change indicated on the Nullmeter. Adjust R110 for a Nullmeter reading change of less than ±100 microvolts between the open and closed positions of the switch. The total offset of the output generated by adjusting R110 can be ignored. Only the change in the reading between switch positions is of importance at this point. After adjusting R110, return to paragraph 5-8 and repeat the steps of paragraphs 5-8 and 5-9.

5-11 DC CALIBRATION

5-12 100 AMPERE RANGE

5-13 Connect the equipment as shown in Figure 5-2 with connections to the Model 2555A and Model 2575 100 ampere jacks. Set the DC Voltage Standard to zero volts. Adjust R7, on the circuit board, for an indication on the DC Nullmeter of ±100 microvolts or less.

NOTE

If the calibration is being performed because IC2 was replaced, set R7 to mid-range and adjust R9 for an indication on the Nullmeter of ±100 microvolts, or less.

Table 5-1. Required Test Equipment.

ITEM	REQUIRED ACCURACY
DC Voltage Standard	0-1V DC, ±0.003% Accuracy.
5-Digit DVM	±0.003% Accuracy, 10 Megohms Input Impedance on 1 V DC Range.
Thermal Transfer System	Fluke Model 540, or equivalent.
AC Voltmeter	Hewlett Packard 3450A001, or equivalent.
AC Voltage Standard	Optimation Model 126, or equivalent.
External Shunt System	Valhalla Model 2575, or equivalent.
Nullmeter	Fluke Model 845AB, or equivalent.

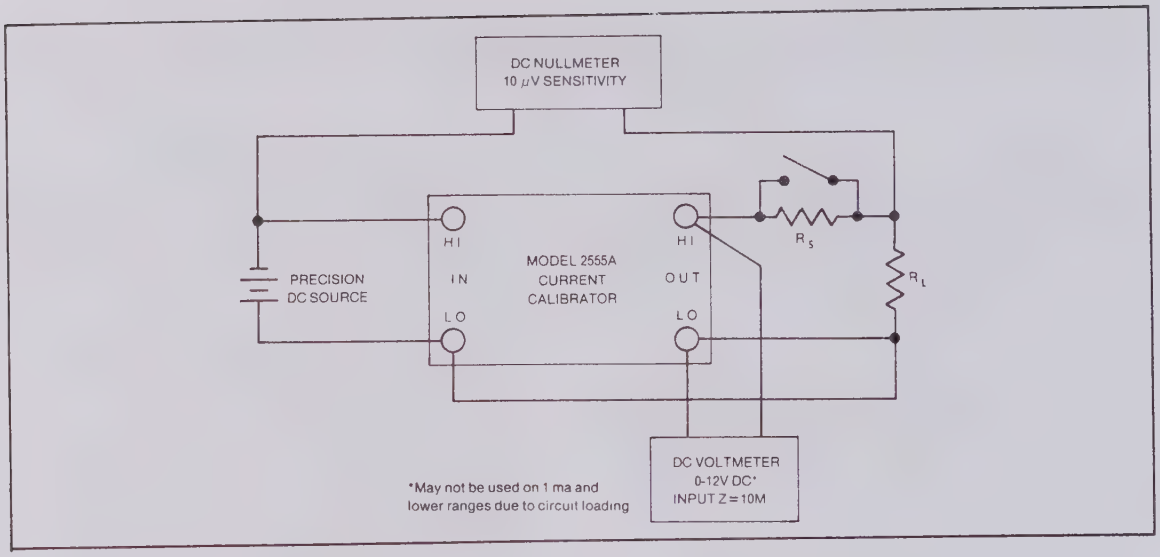


Figure 5-1. Output Impedance Test Equipment Set-up.

5-14 Set the DC Voltage Standard for 1.00 volt. Verify that the Nullmeter indication is ±400 microvolts, or less. Verify, also, that the DVM reading is 1.00 volt.

NOTE

If the specified indications are not obtained, it will be necessary to file or shunt resistor R107B. Internal adjustments are not provided for the 100 ampere range and these methods are necessary to bring the DVM reading within limits.

5-15 10 AMPERE RANGE

5-16 Make connections to the Model 2555A and Model 2575 10 ampere jacks. Set the DC Voltage Standard to zero volts. Check for an indication on the Nullmeter of ± 100 microvolts. Adjust R7, if required.

5-17 Set the DC Voltage Standard for 1.00 volt. Adjust R108 for an indication on the Nullmeter of ± 400 microvolts or less.

5-18 1 AMPERE RANGE

5-19 Make connections to the Model 2555A and Model 2525 1 ampere jacks. Set the DC Voltage Standard to zero volts. Check for an indication on the Nullmeter of ±100 microvolts. Adjust R7, if required.

5-20 Set the DC Voltage Standard for 1.00 volt. Adjust R105 for an indication on the Nullmeter of ± 400 microvolts or less.

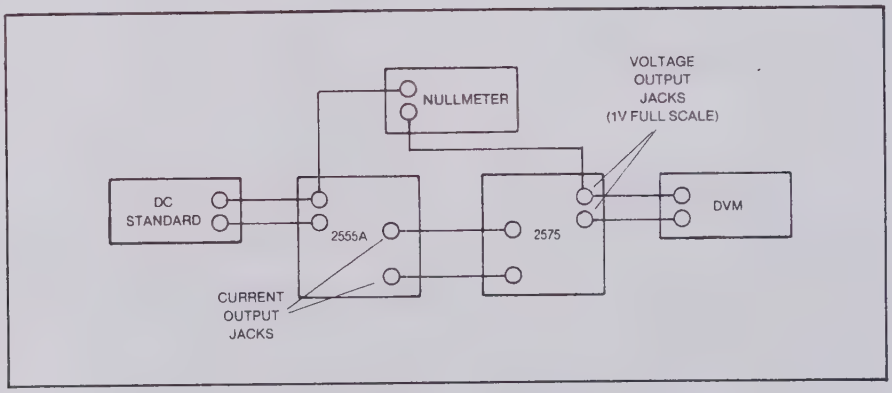


Figure 5-2. DC Calibration Test Equipment Set-up.

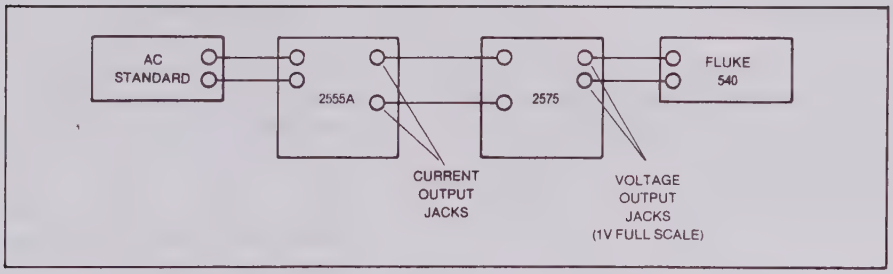


Figure 5-3. AC Frequency Response Test Equipment Set-up.

5-21 100 MILLIAMPERE RANGE

5-22 Make connections to the Model 2555A and Model 2575 100 milliampere jacks. Set the DC Voltage Standard to zero volts. Check for an indication on the Nullmeter of ±100 microvolts. Adjust R7, if required.

5-23 Set the DC Voltage Standard for 1.00 volt. Adjust R105 for an indication on the Nullmeter of ±400 microvolts or less.

5-24 10 MILLIAMPERE RANGE

5-25 Make connections to the Model 2555A and Model 2575 10 milliampere jacks. Set the DC Voltage Standard to zero volts. Check for an indication on the Nullmeter of ±100 microvolts. Adjust R7, if required.

5-26 Set the DC Voltage Standard for 1.00 volt. Adjust R99 for an indication on the Nullmeter of ±400 microvolts or less.

5-27 1 MILLIAMPERE RANGE

5-28 Make connections to the Model 2555A and Model 2575 1 milliampere jacks. Set the DC Voltage Standard to zero volts. Check for an indication on the Nullmeter of ±100 microvolts. Adjust R7, if required.

5-29 Set the DC Voltage Standard for 1.00 volt. Adjust R105 for an indication on the Nullmeter of ±400 microvolts or less.

5-30 FREQUENCY RESPONSE

5-31 The frequency response test need not be performed on a routine basis as the 1 KHz bandwidth is inherent in the design. The frequency response test is an exacting procedure requiring the specialized test equipment listed in Table 5-1, which is not found in most service laboratories. Before attempting to perform this test, it is recommended that paragraph 3-14, Application Information, be completely reviewed and that the test operator thoroughly understand the sources of errors and compensates for them during the test. If test equipment other than that listed in Table 5-1 is to be used, a comparison of specifications of the equipment listed and that to be used must be made to insure that the equipment used is an exact replacement.

5-32 100 AMPERE RANGE

5-33 Connect the equipment as shown in Figure 5-3. Set the Model 540 Mode switch to the AC Transfer position and the Range switch to the 1V range. Make connections to the Model 2555A and Model 2575 100 ampere jacks.

5-34 Set the AC Voltage Standard to 100 Hz and 0.700 volts RMS. Null the Model 540 galvanometer to zero.

5-35 Increase the frequency output of the AC Voltage Standard to 1000 Hz and verify tht the outut does not change by more than 0.25%.

5-36 10 AMPERE RANGE

5-37 Make connections to the Model 2555A and Model 2575 10 ampere jacks. Repeat the steps of paragraphs 5-34 and 5-35.

5-38 1 AMPERE RANGE

5-39 Make connections to the Model 2555A and Model 2575 1 ampere jacks. Repeat the steps of paragraphs 5-34 and 5-35.

5-40 100 MILLIAMPERE RANGE

5-41 Make connections to the Model 2555A and Model 2575 100 milliampere jacks. Repeat the steps of paragraphs 5-34 and 5-35.

5-42 10 MILLIAMPERE RANGE

5-43 Make connections to the Model 2555A and Model 2575 10 milliampere jacks. Repeat the steps of paragraphs 5-34 and 5-35.

5-44 1 MILLIAMPERE RANGE

5-45 Make connections to the Model 2555A and Model 2575 1 milliampere jacks. (If the load for the Model 2555A is something other than the Model 2575, the total shunt capacitance, including leads and resistor capacitance, must not exceed 200 picofarads). Repeat the steps of paragraphs 5-34 and 5-35.

NOTE

For factory certifications with National Bureau of Standards traceability, contact your local Valhalla sales representative or Valhalla Scientific, Inc.

5-46 RANGE INDICATOR ADJUSTMENT

5-47 Connect the DC Standard plus (+) output terminal to the plus (RED) input terminal of the Model 2555A and the minus (-) output to the minus ~~(WHITE)~~ BLACK input of the Model 2555A. Connect a 5K ohm resistor across the 1 MA output jack of the Model 2555A and connect the DVM across the resistor. Increase the DC Standard output until the DVM reads +5 volts. Adjust R19 to just turn on the yellow panel indicator. The green indicator will be turned off. Increase the DC Standard output for a +7 volt reading on the DVM. Adjust R15 to just turn on the red indicator. The yellow indicator will be turned off. Reverse polarity of the input to the Model 2555A and repeat the procedure, but adjust R17 and R13 instead of R9 and R15.

5-48 TROUBLESHOOTING

5-49 Difficulties with precision equipment often arise due to misinterpretation of the specifications. Make a careful check with precision test equipment to determine that the equipment is malfunctioning before initiating repair procedures.

5-50 POWER SUPPLIES

5-51 The 20 volt power supplies are formed by diodes CR14, CR15, CR16 and CR17. These supplies are unregulated and the voltage will vary from 18.5 to 21.5 volts depending on line voltage and load.

5-52 The 15 volt power supplies are formed by integrated circuit voltage regulators IC8 and IC9. Their voltages will vary slightly from unit to unit due to component tolerances and will typically be near 14.2 volts.

5-53 The 5 volt supplies for the current shunt amplifier are comprised of CR1 through CR4 and integrated circuit amplifiers IC5 and IC6. These voltages will vary slightly from unit to unit and are typically 4.95 volts.

5-54 AMPLIFIER SERVICING

5-55 Before attempting to service the amplifiers of the Model 2555A, it is recommended that the technician review the Theory of Operation presented in Section IV. The following procedure is only an aid to isolate a catastrophic malfunction to a local area. Short the input terminals and short the output terminals. With the differential DC voltmeter, measure the voltage beween the common connections of the power transistor emitter resistors and pin 6 of IC1. This voltage must be less than 15 millivolts. If it is greater than 15 millivolts, IC1 is most likely defective. If it is less than 15 millivolts, the malfunction is somewhere in the second amplifier (and/or the current amplifiers), or the feedback network.

NOTE

If IC1, IC2, Q6 through Q14, Q16 through Q24, Q26 through Q34, Q36 through Q44 or R44 through R110 are replaced, the AC FREQUENCY RESPONSE TEST MUST BE PERFORMED. Contact your Valhalla sales representative or Valhalla Scientific, Inc. if the AC Frequency Response Test is not satisfactory.

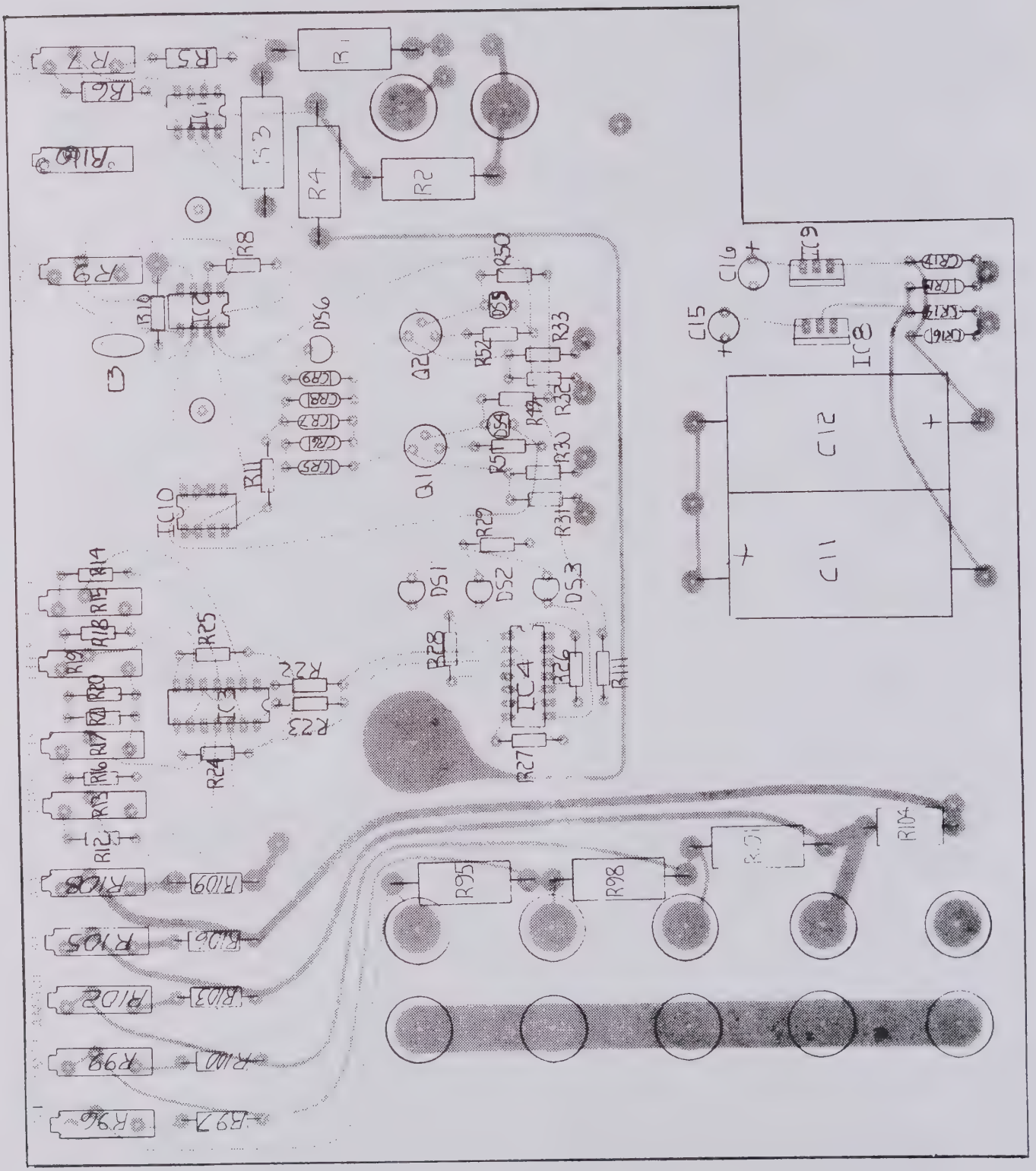


Figure 5-3. Circuit Board Component Locations (Assembly).

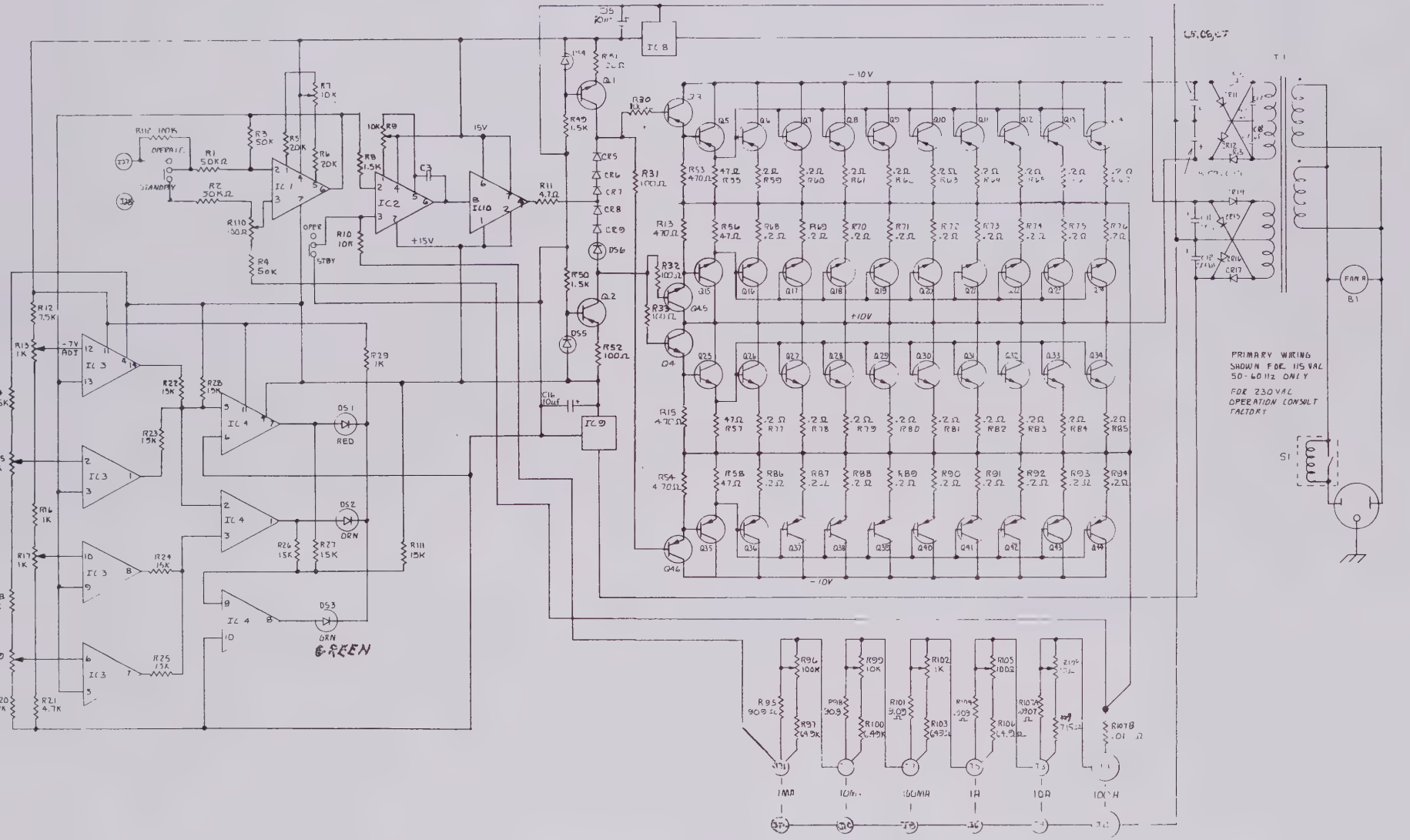


Figure 5-4. Schematic Diagram, Model 2555A AC-DC Current Calibrator.

Valhalla Scientific Inc

PARTS LIST

REF. DES.	V.S. P/N	DESCRIPTION	MFG.	MFG. P/N
B 1	5-10092	10" FAN	82877	CL2L2
C 5-10	2-40007	CAP ELECT 110,000/20V	00853	500R114 U20DF2B
C 17, 18	2-60005	CAP PAPER 4.7μf		MPE25-4.7MFD
CR 10, 11	3-20013	DIODE, RECT		1N3288A
CR 12, 13	3-20014	DIODE RECT		1N3288AR
Q 3, 45	3-10002	TRANSISTOR PNP		2N4036
Q 4, 46	3-10007	TRANSISTOR NPN		2N2102
Q 5 - 24	3-10009	TRANSISTOR PNP		2N6248
Q 25 - 44	3-10008	TRANSISTOR NPN		2N3055
R 13, 15, 53, 54	1-01033	RES FXD 470Ω 5%	81349	RC07GF471J
R 55-58	1-01015	RES FXD 47Ω 5%	81349	RC07GF470J
R 59 - 94	1-30008	RES FXD 0.2Ω 8W	MILLS	
T 1	4-20014	POWER TRANSFORMER	53504	2550-010
2 ea	4-10106	BUSS BAR	53504	2555-203B
1 ea	4-10107	GND BAR	53504	2555-204A
2 ea	4-10125	H.S. BKT	53504	2555-209A
2 ea	4-10126	RECT, H.S.	53504	2555-210A
4 ea	4-10116	OUTPUT BUSS BAR	53504	2555-214A
4 ea	4-10117	OUTPUT BUSS BAR BKT	53504	2555-213
1 ea	4-10103	REAR PANEL	53504	2555-200
4 ea	4-10165	COPPER WASHER	53504	2555-219
1 ea	5-10119	STRAIN RELIEF	LAPP	L-11
1 ea	5-10110	FINGER GUARD	82877	476323
1 ea	5-10107	POWER CORD	70903	17629
1 ea	4-10135	CHASSIS	TDJ	B-S1050-17-1700H
1 ea	4-10185	PHENOLIC PLATE	53504	2555-220
2 ea	4-10188	MTG BRACKET	53504	2555-221
2 ea	4-10189	MTG BRACKET	53504	2555-222
1 ea	4-10190	REAR PANEL INSULATOR	53504	2555-223A
1 ea	4-10191	FAN SPACER	53504	2555-224
2 ea	4-10192	SUPPLY BUSS	53504	2555-225
4 ea	4-10193	OUTPUT STRAP	53504	2555-226
1 ea	4-10194	XFMR BKT REAR	53504	2555-227
1 ea	4-10195	XFMR BKT FRONT	53504	2555-228
1 ea	4-10205	SHUNT CONN STRAP	53504	2555-235
1 ea	4-10206	TERMINAL STRIP	53504	2555-236
1 ea	4-10207	IC HOLD DOWN	53504	2555-237
2 ea	5-10128	#4 LUG 3/8" STUD	BELDEN	716796
14 ea	5-10160	#4 LUG 1/4" STUD	SMITH	9681
6'		#4 AWG WIRE	BELDEN	

MODEL:	TITLE:	SHT OF
2555	CHASSIS	1 2

Valhalla Scientific Inc

PARTS LIST

REF. DES.	V.S. P/N	DESCRIPTION	MFG.	MFG. P/N
2 ea	4-10208	COVER	53504	2555-238
8 ea	4-10209	HEATSINK	53504	2555-239
1 ea		7" x 10" ALUM SCREEN WIRE		

MODEL:	TITLE:	SHT
2555	CHASSIS	2 OF 2

Valhalla Scientific Inc

PARTS LIST

REF. DES.	V.S. P/N	DESCRIPTION	MFG.	MFG. P/N
C3	2-10001	CAP CERM 200pf	56289	5GAT20
C15, 16	2-30001	CAP TAN 10μf/16V	05397	T360B106M025AS
C11, 12	2-40008	CAP ELEC 500/50	56289	TVA-1315
CR5-9	3-20000	DIODE		1N914
CR 14-17	3-20002	DIODE, RECT		1N4001
DS 1	5-01011	LED, RED		5082-4655
DS 2	5-01012	LED, YELLOW		5082-4555
DS 3	5-01013	LED GREEN		5082-4955
DS 4-6	5-01005	LED	00001	MV5074
IC 1, 2	3-30041	OP AMP	BURR BRN	3521-L
IC 3,4	3-30031	QUAD OP AMP	27014	LM324N
IC 8	3-30037	IC REG - 15V	27014	LM320T-15
IC 9	3-30036	IC REG + 15	27014	LM340T-15
IC 10	3-30069	OP AMP	27014	LH0002CH
J 1	5-10104	RECPT 100A - RED	58474	RS100GR
J 2	5-10103	RECPT 100A - WHT	58474	RS100GWT
J 3, 5, 7, 9, 11, 27	5-10021	BINDING POST - RED	83330	#257-RED
J 4, 6, 8, 10, 12	5-10102	BINDING POST - WHT	83330	#257- WHT
J 28	5-10020	BINDING POST - BLK	83330	#257- BLK
P1	5-10106	PLUG - 100A - RED	58474	PP100GR
P2	5-10105	PLUG - 100A - WHT	58474	PP100GWT
Q1	3-10007	TRANSISTOR - NPN	27014	2N2102
Q 2	3-10002	TRANSISTOR - PNP	27014	2N4036
R1, 2, 3, 4	1-20034	RES WW 50 K .01%	53504	1-20034 50KΩ
R 107 A, B	1-20059	RES FXD .01Ω/.09Ω	MTD	1-20059
R5, 6	1-10012	RES MF 20K 1%	81349	RN60C2002F
R 7, 9, 99	1-50023	RES VAR 10K	80294	3006P-1-103
R 8, 49, 50	1-01043	RES CF 1.5K 5%	81349	RC07GF152J
R10	1-01061	RES CF 10K 5%	81349	RC07GF103J
R 11	1-01004	RES CF 4.7Ω5%	81349	RC07GF4R7J
R 20, 21	1-01053	RES CF 4.7K 5%	81349	RC07GF472J
R 13, 15, 17, 19, 102	1-50022	RES VAR 1K	80294	3006P-1-102
R 16, 18, 29	1-01041	RES CF 1K 5%	81349	RC07GF102J
R 22-28, 111	1-01063	RES CF 15K 5%	81349	RC07GF153J
R 30-33, 51, 52	1-01021	RES CF 100Ω 5%	81349	RC07GF101J
[illegible]	1-20050	RES WW909Ω .1%	53504	1-20050
R 97	1-10072	RES MF 64.9 K 1%	81349	RN60C6492F
[illegible]	1-20049	RES WW90.9Ω .1%	53504	1-20049
R 100	1-10071	RES MF6.49K1%	81349	RN60C6491F

MODEL:	TITLE:	SHT OF
2555	F. P. & P. C. Assembly	1 2

Valhalla Scientific Inc

PARTS LIST

REF. DES.	V.S. P/N	DESCRIPTION	MFG.	MFG. P/N
R 101	1-20048	RES WW 9.09Ω .1%	53504	1-20048
R 105, 110	1-50025	RES VAR 100Ω	80294	3006P-1-101
R 103	1-10070	RES MF 649Ω 1%	81349	RN60C6490F
R 106	1-10069	RES MF 64.9Ω 1%	81349	RN60D64R9F
R 104	1-20047	RES WW .909Ω .1%	53504	1-20047
R 108	1-50021	RES VAR 10Ω	80294	3006P-1-100
R 109	1-10068	RES MF 7.15Ω 1%	81349	RN60D7R15F
R 96	1-50031	RES VAR 100K	80794	3006P-1-104
R 12, 14	1-01059	RES CF 7.5K 5%	81349	RC07GF752J
R 112	1-01081	RES FXD 100K 1/4W 5%	81349	RC07GF104J
S 1	5-03014	20A CIRCUIT BREAKER	74193	JA1-A3-A-20-2
S 2	5-03030	STAND BY SWITCH	SCHADOW	ZF FA200 Blk Yellow/2UEE
1 ea	4-30032	P.C. BOARD	53504	2555-700C
1 ea	4-10108	FRONT PANEL	53504	2555-205B
2 ea	5-10005	STANDOFF	USECO	1530B-3/16

MODEL:	TITLE:	SHT OF
2555	F. P. & P.C. ASSEMBLY	2 2

FEDERAL SUPPLY CODE
for
MANUFACTURERS CATALOGING HANDBOOK H4-1

00001	Monsanto, Electronic Special Products, Cupertino, Calif.
00656	Aerovox Corporation, New Bedford, Mass
00853	Sangamo Electric Company, Pickens, S.C.
01121	Allen-Bradley Company, Milwaukee, Wisc.
01255	Litton Industries, Inc., Beverly Hills, Calif.
01281	T R W Semiconductors, Inc., Lawndale, Calif.
01295	Texas Instruments, Inc., Dallas, Texas
02335	Fairchild Controls Corp., Hicksville, LI, N.Y.
02660	Amphenol Corporation, Broadview, N.Y.
03507	General Electric Company, Syracuse, N.Y.
04713	Motorola Semiconductor Prod., Inc., Phoenix, Ariz.
04963	3-M, St. Paul, Minn.
05276	Pomona Electronics Co., Inc., Pomona, Calif.
05397	Kemet, Union Carbide Corp., Cleveland, Ohio
05820	Wakefield Engineering, Inc., Wakefield, Mass.
07088	Kelvin Electric Company, Van Nuys, Calif.
07256	Silicon Transistor Corp., Garden City, N.Y.
07263	Fairchild Camera and Instr. Corp., Mt. View, Calif.
07716	I R C, Incorporated, Burlington, Iowa
07910	Continental Devices, Hawthorne, Calif.
08065	Accurate Rubber and Plastics Co., San Diego, Calif.
09026	Babcock Electronics Corp., Costa Mesa, Calif.
12405	Hysol Corporation, El Monte, Calif.
12406	Elpac, Incorporated, Fullerton, Calif.
12697	Clarostat Mfg. Co., Incorporated, Dover, N.H.
13454	Texas Crystals, River Grove, Ill.
14655	Cornell-Dubilier Elect. Corp., Newark, N.J.
14752	Electro Cube, Incorporated, San Gabriel, Calif.
16758	Delco Radio Div., General Motors, Kokomo, Ind.
17838	Mektron, California General, Inc., Chula Vista, Calif.
18324	Signetics, Sunnyvale, Calif.
18722	R C A, Mountaintop, Pa.
21604	Buckeye Stamping Company, Columbus, Ohio
25684	Victoreen Instrument Co., Inc., Oak Lawn, Ill.
27014	National Semi-Conductor Corp., Santa Clara, Calif.
27556	IMB Electronic Products, Santa Fe Springs, Calif.
28480	Hewlett-Packard Co., Palo Alto, Calif.
30983	Electra/Midland, San Diego, Calif.
44655	Ohmite Manufacturing Company, Skokie, Ill.
71279	Cambridge Thermionic Corp., Cambridge, Mass.
71400	Bussmann Mfg. Div., McGraw-Edison Co., St. Louis, Mo.
71450	CTS Corporation, Elkhart, Ind.
71468	ITT Cannon Electric, Inc., Los Angeles, Calif.
71590	Centralab Div., Globe-Union, Inc., Milwaukee, Wisc.
71785	Cinch Manufacturing Company, Chicago, Ill.
73899	J F D Electronics Company, Brooklyn, N.Y.
75915	Littlefuse, Incorporated, Des Plaines, Ill.
76055	Mallory Controls, Frankfort, Ind.
76493	J. W. Miller Company, Los Angeles, Calif.
78488	Stackpole Carbon Company, St. Marys, Pa.
80294	Bourns, Incorporated, Riverside, Calif.
81095	Triad Transformer Corp., Venice, Calif.
81312	Winchester Electronics, Oakville, Ct.
81349	Military Spec., Standardization Division, Chicago, Ill.
82389	Switchcraft, Incorporated, Chicago, Ill.
83330	Herman H. Smith, Inc., Brooklyn, N.Y.
84171	Arco Electronics, Inc., Great Neck, N.Y.
86684	R C A, Harrison, N.J.
88245	Useco Div., Litton Industries, Van Nuys, Calif.
90201	Mallory Capacitor Company, Indianapolis, Ind.
91637	Dale Electronics, Inc., Columbus, Neb.
91929	Micro Switch Div., Honeywell, Inc., Freeport, Ill.
92194	Alpha Wire Corporation, Elizabeth, N.J.
93332	Sylvania Electric Products, Inc., Woburn, Mass
98978	IERC, Burbank, Calif.
00002	Jordan Electronics, Van Nuys, Calif.
53504	Valhalla Scientific, Inc., San Diego, Calif.

MODEL 2555A

AC-DC CURRENT CALIBRATOR

ORDERING INFORMATION

MODEL 2555A	AC-DC CURRENT CALIBRATOR
OPTION "HMF"	6-FOOT, 100 AMPERE OUTPUT CABLE SET
OPTION "T"	MOBILE TEST STAND
OPTION "R"	RACK MOUNT ADAPTER
OPTION "C"	INPUT CABLE SET

FOB:San Diego, Calif. Terms: Net 30 Days DELIVERY Stock to 30 days

Valhalla Scientific Inc.

7707 Convoy Ct., San Diego, California 92111
(714)277-2732

www.manualsplus.com
1020751